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Medication use among senior Canadians

by Pamela L. Ramage-Morin

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Abstract

Based on data from the 1996/1997 (institutional component) and 1998/1999 (household component) National Population Health Survey, seniors were major consumers of prescription medications, over-the-counter (OTC) products, and natural and alternative medicines. Almost all (97%) seniors living in long-term health care institutions were current medication users (medication use in the two days before their interview), as were 76% of those living in private households. Over half (53%) of seniors in institutions and 13% of those in private households used multiple medications (currently taking five or more different medications). Both medication and multiple medication use were associated with morbidity. Medications for the nervous system, the alimentary tract and metabolism, and the cardiovascular system were reported most frequently. Among seniors in institutions, those with Alzheimer's disease were less likely to take multiple medications than were those without this condition.

Keywords

aging, cross-sectional studies, morbidity, non-prescription drugs, polypharmacy, prescription drugs

Author

Pamela L. Ramage-Morin (613-951-1760, Pamela.Ramage-Morin@statcan.gc.ca) is with the Health Information and Research Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Prescription medications, over-the-counter (OTC) products, and natural and alternative medicines are widely used in Canada, especially by seniors. But while medications play an important role in health care and disease management, their use is not without risk.[1]

Multiple medication use (prescription or OTC) is a common concern in relation to seniors' health.[2-5] In 2005, pharmacists dispensed an average of 35 prescriptions per person aged 60 to 79, and 74 prescriptions per person aged 80 or older, compared with an overall average of 14 prescriptions per Canadian.[6] People who take several medications at once are more likely to have adverse drug reactions; seniors are particularly vulnerable because of co-morbidity and physiological changes that come with age.[3,4,7-9]

There is a need in Canada for information about the number of seniors who use medications and those who have an elevated risk of drug-related adverse events from multiple medication use. The current study addresses these issues with data from nationally representative samples of seniors living in private households and in long-term health care institutions (see *The data*). In addition, the study reveals the most commonly reported types of medications and health-related factors associated with seniors' medication use.

Medication use

Nearly all residents of health care institutions were current medication users: 97% had taken some form of medication in the past two days (Table 1). As well, a large majority (76%) of seniors living in private households had done so.

Among the household population, women were more likely than men to have taken medications in the past two days, and seniors aged 75 to 84 were more likely to have done so than those aged 65 to 74. Differences based on educational attainment or the use of proxy reporters were not evident.

For seniors in institutions, the likelihood of taking medication did not differ by sex, age group, educational attainment, or proxy response.

Multiple medication use

Multiple medication use (taking five or more different drugs in the past two days) was reported for 53% of seniors in health care institutions and 13% of those in private households (Table 1, Figure 1). The likelihood of multiple

The data

Estimates of seniors' medication use were based on the latest cycles of the National Population Health Survey (NPHS) that collected information on medication use in the two days before their interview. Detailed documentation on the NPHS can be found on Statistics Canada's website (http://www.statcan.ca), and descriptions of the survey design, sample, and interview procedures are available in published reports.[10,11]

The NPHS *household file* covers household residents in all provinces, except persons living on Indian reserves, on Canadian forces bases, and in some remote areas. The data in this analysis are from 1998/1999 (cycle 3), which has a household response rate of 87.6% and a selected person response rate of 98.5%. Eleven percent of the senior household sample (317) relied on proxy reporters (Appendix Table A).

The NPHS *health institutions file* covers people living in hospitals, nursing homes, and facilities for people with disabilities. The data in this analysis are from 1996/1997 (cycle 2), which has institutional and individual response rates of 100% and 89.9%, respectively. Fifty-nine percent of the institutionalized respondents (1,013) relied on proxy reporters—49% were family members, and 10% were staff of the institutions.

Demographic distributions of the samples and populations used in this analysis are presented in Appendix Table A.

The primary outcome variables in this study are *medication use* and *multiple medication use*. *Medication use* refers to prescription and OTC medications including natural and alternative medicines. Household residents, who were usually interviewed by telephone, were asked to gather their medications and read the names from the containers. For institutionalized respondents, staff members of the institutions provided this information; these medications would all be classified as "prescribed," because seniors in institutions usually do not have the option of self-medicating. *Current users* were those who had taken medication in the two days before their interview.

The terms *multiple medication use* and *polypharmacy* are sometimes used interchangeably. The latter has been defined in the literature in relative terms (for example, the administration of an excessive number of drugs) and in absolute terms, ranging from two to more than six simultaneous medications.[5,12-15] In this study, preference is given to the term, *multiple medication use,* defined as *currently* taking five or more different medications. The threshold of five is relatively conservative alongside other absolute definitions of polypharmacy, and is consistent with an earlier Statistics Canada study based on the NPHS.[16]

NPHS respondents reporting current medication use were asked the names of their medications; data were recorded for a maximum of 12 medications. Drugs were listed in the order that they were reported, and so could not be ranked according to strength or importance. The drugs were coded using the Canadian edition of the *Anatomical Therapeutic Chemical (ATC) Classification System for Human Medications*.

Self-perceived health was based on the question, "In general, would you say your health is: ...." The five response categories were combined into two groups: good/very good/excellent health was defined as "positive" self-perceived health, and fair/poor health as "negative" self-perceived health.

Chronic pain was defined as a response of "no" to the question, "Are you usually free of pain or discomfort?"

The presence of *chronic conditions* was established by asking respondents if they had been diagnosed by a health professional with a long-term chronic health condition—one that had lasted, or was expected to last, at least six months. Respondents were read a list of conditions. Individual conditions included in this study were incontinence, arthritis, diabetes, heart disease, stroke, Alzheimer's disease or other dementia, and cataracts. For the institutional population, *incontinence* included urinary incontinence and difficulty controlling bowels, but for the household population, was limited to urinary incontinence. A more comprehensive list of chronic conditions was used to estimate the overall *number of chronic conditions* each respondent experienced (Appendix Table B). The count of chronic conditions was categorized into three groups: none or 1, 2, and 3 or more.

The analysis was based on independent samples from households and institutions. Data were weighted to reflect the age and sex distribution of the appropriate target populations. Weighted frequencies and cross-tabulations were used to estimate the proportion of people who had used medication/multiple medications in the past two days by selected characteristics. Logistic regression was used to model associations between indicators of ill health (chronic pain and number of chronic conditions) and multiple medication use while controlling for sex, age, education, and proxy reporting status. To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.[17-19]

The current study has a number of limitations. The data on institutions are from the 1996/1997 NPHS, whereas the household data are from the 1998/1999 NPHS. These surveys are the most recent from which multiple medication use can be established. The count of chronic conditions may vary between household and institutional residents, in part, because the lists of conditions were not identical in the two surveys (Appendix Table B). As well, chronic conditions were self-reported and were not verified by any other source.

Respondents who reported medication use in the past two days were limited to providing the names of 12 different drugs. Seven of the 2,851 household sample and 27 of the 1,711 institutional sample reported more than 12 different medications. For an additional 18 household and 73 institutional respondents, data on the number of different medications taken in the past two days were missing.

It is possible that respondents may not consider certain OTC products such as vitamins and natural/herbal products to be drugs, in which case the true number of medications taken would be under-reported.

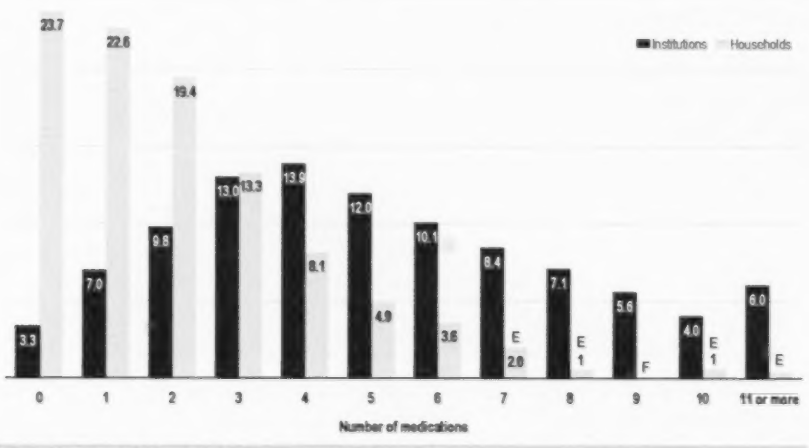
A substantial share of the respondents—11% of the household sample and 59% of the institutional sample—relied on proxy reporters. However, excluding these respondents (the most seriously ill or cognitively impaired seniors) would have biased the results.

Table 1
Percentage using medications and multiple medications in past two days, by selected characteristics, household and institutional populations aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)

	Medication use						Multiple medication use					
	Households			Institutions			Households			Institutions		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
	Percentage	from	to	Percentage	from	to	Percentage	from	to	Percentage	from	to
Total	76.3	74.2	78.4	96.7	95.8	97.6	12.8	11.0	14.7	53.1	49.7	56.5
Sex												
Men	71.9*	68.8	74.9	96.5	94.9	98.1	11.6	9.2	14.0	51.3	45.9	56.7
Women†	79.7	77.0	82.4	96.8	95.7	97.8	13.8	11.5	16.2	53.8	49.8	57.8
Age group												
65 to 74†	73.4	70.4	76.3	97.2	95.3	99.2	10.5	8.5	12.5	52.6	45.8	59.5
75 to 84	80.8*	77.4	84.2	96.9	95.3	98.4	16.3*	13.3	19.4	56.9	51.9	61.9
85 or older	77.9	71.2	84.5	96.4	95.2	97.6	14.4E	7.3	21.5	50.7	46.3	55.1
Education												
Less than secondary graduation†	76.9	74.1	79.8	96.7	95.6	97.7	14.2	11.6	16.7	54.5	50.6	58.5
Secondary graduation or more	75.7	72.7	78.7	97.0	95.5	98.5	11.6	9.4	13.8	51.1	44.9	57.2
Proxy reporter												
Yes	75.8	69.7	81.9	96.8	95.6	97.9	14.4	9.8	19.1	45.4*	41.0	49.8
No†	76.4	74.2	78.5	96.6	95.2	98.0	12.6	10.6	14.5	64.9	60.3	69.5

† reference category
* significantly different from estimate for reference category ($p<0.05$)
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions)

Figure 1
Percentage using medications in past two days, by number of medications, household and institutional populations aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)



E use with caution (coefficient of variation 16.6% to 33.3%)
F too unreliable to be published (coefficient of variation greater than 33.3%)
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions)

medication use did not differ by sex, regardless of whether seniors lived in private households or in institutions.

Only among household residents was there a difference by age group—those aged 75 to 84 were more likely to be multiple medication users than were younger seniors (16% compared with 11%). For institutionalized seniors, those who relied on proxy reporters were significantly less likely to report multiple medication use (45%) than were those who responded on their own behalf (65%).

Medication use, including the use of multiple medications, tended to be positively associated with indicators of ill health. For example, seniors who assessed their general health as poor were more likely to have used five or more different medications in the past two days than were those in better health (Table 2). As well, the number of chronic conditions reported, the presence of chronic pain, and having specific chronic conditions were

associated with medication use (Table 2). Even when sex, age, education, and proxy reporter were taken into account, the presence of chronic pain and a greater number of chronic conditions were each independently associated with higher odds of using multiple medications in the fully controlled model (Table 3).

A notable exception to the positive associations between chronic conditions and medication use emerged for institutionalized seniors who had Alzheimer's disease or other dementia (Table 2). They were less likely to be multiple medication users than were institutionalized seniors without this condition: 40% compared with 62%. This is the reverse of the association for seniors in households, among whom a higher proportion with Alzheimer's disease reported using multiple medications (34%), compared with those without this condition (13%). Among institutionalized seniors, the average

Table 2
Percentage using medications and multiple medication in past two days, by self-perceived health, chronic pain and other major chronic conditions, household and institutional populations, aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)

	Medication use						Multiple medication use					
	Households			Institutions			Households			Institutions		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
	Percentage	from	to	Percentage	from	to	Percentage	from	to	Percentage	from	to
Total	76.3	74.2	78.4	96.7	95.8	97.6	12.8	11.0	14.7	53.1	49.7	56.5
Poor self-perceived health												
Yes	91.1*	88.2	94.0	97.5	96.5	98.5	32.2*	27.3	37.2	58.8*	54.6	63.0
No†	71.9	69.5	74.4	95.6	93.9	97.3	7.1	5.7	8.5	45.6	40.9	50.3
Chronic pain												
Yes	89.0*	85.9	92.1	97.9*	96.8	98.9	23.6*	19.0	28.2	66.6*	61.4	71.8
No†	71.7	69.3	74.2	96.2	94.9	97.4	8.9	7.2	10.6	45.8	41.5	50.0
Incontinence												
Yes	87.5*	81.8	93.3	97.0	95.8	98.2	26.6*	19.0	34.3	52.5	48.6	56.4
No†	75.4	73.2	77.5	96.3	94.8	97.7	11.7	9.8	13.7	54.0	49.2	58.7
Arthritis												
Yes	84.7*	82.2	87.3	97.3	96.0	98.7	18.8*	15.8	21.9	62.2*	58.6	65.9
No†	69.4	66.6	72.3	96.1	94.9	97.4	8.0	6.1	9.9	45.3	40.9	49.6
Diabetes												
Yes	92.8*	89.3	96.4	100.0*	100.0	100.0	31.6*	24.4	38.8	74.6*	69.7	79.5
No†	74.2	71.9	76.5	96.1	95.1	97.1	10.4	8.8	12.1	49.3	45.6	53.1
Heart disease												
Yes	97.9*	96.6	99.2	98.3*	96.7	99.9	37.1*	31.3	42.9	67.7*	62.7	72.7
No†	71.8	69.4	74.2	96.1	95.0	97.2	7.8	6.3	9.3	47.7	43.6	51.9
Stroke												
Yes	93.4*	87.6	99.3	99.0*	98.0	100.0	30.6*E	20.5	40.7	61.5*	56.7	66.2
No†	75.5	73.3	77.7	96.0	94.9	97.1	12.0	10.2	13.8	50.6	46.6	54.5
Alzheimer's disease or other dementia												
Yes	87.1	75.1	99.0	96.0	94.4	97.5	33.7*E	14.4	53.1	39.7*	34.9	44.4
No†	76.2	74.1	78.3	97.2	96.2	98.1	12.6	10.8	14.4	61.7	58.0	65.3
Cataracts												
Yes	85.4*	81.3	89.5	96.4	94.8	98.0	17.0*	12.8	21.3	57.4*	51.8	63.0
No†	74.3	72.0	76.6	96.8	95.9	97.8	11.9	10.0	13.8	51.3	47.8	54.8
Number of chronic conditions												
None or one†	57.5	54.0	61.0	93.4	90.8	96.6	2.4E	1.3	3.4	43.0	35.7	50.4
Two	85.0*	81.5	88.5	94.9	91.7	98.2	8.2*E	5.6	10.9	38.2	31.0	45.5
Three or more	93.9*‡	91.9	95.8	97.9*	97.0	98.8	29.7*‡	25.6	33.8	58.6*‡	55.0	62.3

† reference category
* significantly different from estimate for reference category ($p<0.05$)
‡ significantly different from estimate for two chronic conditions ($p<0.05$)
E Use with caution (Coefficient of variation between 16.6% and 33.3%)
Note: "Incontinence" includes urinary and bowel incontinence for the institutional population, but is limited to urinary incontinence for the household population.
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions).

age of those with and without Alzheimer's disease did not differ, although those with Alzheimer's disease had, on average, more chronic conditions (4.3 versus 3.4). Despite the tendency toward a greater number of chronic conditions, institutionalized seniors with Alzheimer's disease were less likely have chronic pain (28% versus 44%), less likely to be on pain medication (44% versus 58%), and received, on average, fewer medications overall than did institutionalized seniors without Alzheimer's disease or other dementia (4.4 medications versus 5.9).

Types of medications

The medications reported most commonly by seniors were those that act on the nervous system, the alimentary tract and metabolism, and the cardiovascular system (Table 4).

Almost four out of every five (78%) seniors in institutions and 37% of those in households took medications for the nervous system. Of these medications, analgesics were the most common, followed by psycholeptics, which include antipsychotics, anxiolytics, hypnotics and sedatives.

Medications for the alimentary tract and metabolism were used by 71% of seniors in institutions and 23% of those in households. Of these medications, laxatives were commonly reported for seniors in institutions (62%), followed by antacids, and drugs for the treatment of peptic ulcers and flatulence (34%). For seniors in households, peptic ulcer and flatulence medications were most common (40%), followed by drugs for diabetes (34%); laxatives were rarely reported (9%).

More than half (55%) of seniors in institutions and 44% of those in households reported taking cardiovascular medications. This group of medications is composed of diuretics, cardiac therapy drugs, antihypertensives, calcium channel blockers, and beta-blocking agents. Diuretics were most commonly reported for seniors in institutions, and antihypertensives were prominent for seniors in private households.

Table 3
Adjusted odds ratios relating multiple medication use to selected characteristics, household and institutional populations, aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)

	Multiple medication use					
	Households			Institutions		
	Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
		from	to		from	to
Indicators of ill health						
Chronic pain						
Yes	1.8*	1.3	2.4	2.1*	1.5	3.0
No†	1.0	..	..	1.0	..	..
Number of chronic conditions						
None or one†	1.0	..	..	1.0	..	..
Two	3.4*	1.9	6.0	0.9	0.6	1.4
Three or more	14.8*	8.8	24.9	2.3*	1.5	3.4
Socio-demographic characteristics						
Sex						
Men	1.1	0.8	1.5	0.9	0.7	1.2
Women†	1.0	..	..	1.0	..	..
Age (continuous)	1.0	0.99	1.04	0.99	0.97	1.00
Education						
Less than secondary graduation†	1.0	..	..	1.0	..	..
Secondary graduation	0.9	0.7	1.3	0.9	0.7	1.2
Proxy reporter						
Yes	1.4	0.8	2.2	0.4*	0.3	0.6
No†	1.0	..	..	1.0	..	..
Model information						
Sample size		2,820			1,364	
Sample using multiple medications		365			747	
Records dropped because of missing values		31			347	

.. not applicable
† reference category
* significantly different from estimate for reference category ($p<0.05$)
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions).

Conclusion

This is the first nationwide, population-based study to provide benchmarks of medication and multiple medication use among all Canadian seniors, covering not only private households, but also long-term health care institutions. The stringent collection process for medication information minimizes the potential for recall bias: household residents were asked to read the names of their medications to the interviewer; staff members provided the information for institutionalized respondents. This approach has an advantage over some administrative data in cases when discrepancies emerge between medications that are prescribed and those that are actually used.

Medication use by seniors is common—almost all seniors in institutions and over three-quarters of those in households reported using at least one medication in the past two days. Concurrent use of five or more medications was reported by 53% of seniors in institutions and 13% of those in households. This amounts to over a half million seniors taking multiple medications: approximately 94,000 in institutions and 445,000 in households.

Table 4
Prevalence of type of medication used in past two days, by anatomical system and sub-category, household and institutional populations aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)

		Households		Institutions	
Anatomical system[1]	Sub-category[2]	Estimated population	Prevalance	Estimated population	Prevalance
		thousands	%	thousands	%
Nervous system		1,222	36.6	138	78.3
	Analgesics	939	76.9	88	64.3
	Psycholeptics	276	22.6	76	55.3
	Psychoanaleptics	131	10.7	34	24.4
	Anti-Parkinson drugs	25[E]	2.1[E]	20	14.8
	Antiepileptics	65[E]	5.3[E]	16	11.6
Alimentary tract/metabolism		781	23.5	124	70.8
	Laxatives	74[E]	9.5[E]	78	62.5
	Antacids, drugs for peptic ulcer/flatulence	311	39.8	42	33.7
	Mineral supplements	123	15.7	22	17.8
	Vitamins	95	12.2	22	17.5
	Drugs used in diabetes	269	34.4	19	14.9
Cardiovascular system		1,455	43.5	96	54.9
	Diuretics	536	36.9	56	58.3
	Cardiac therapy	289	19.9	37	39.0
	Antihypertensives	653	44.9	29	30.6
	Calcium channel blockers	330	22.7	21	21.5
	Beta-blocking agents	377	25.9	9	9.5

[1] percent based on all respondents who reported taking at least one medication in past two days
[2] percent based on respondents who reported taking medications for specific anatomical system in previous two days
[E] use with caution (coefficient of variation between 16.6% and 33.3%)
Note: "Incontinence" includes urinary and bowel incontinence for the institutional population, but is limited to urinary incontinence for the household population.
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions)

Although medication use was generally associated with morbidity, this study identified unique circumstances for institutionalized seniors with Alzheimer's disease or other dementia. They tended to have more chronic conditions than institutionalized seniors without Alzheimer's disease, but were less likely to report pain, to have taken pain medications or to be multiple medication users. These findings are consistent with earlier studies that suggest higher levels of cognitive impairment are associated with undetected pain and subsequent under-treatment.[20-23]

Finally, people take several medications at once for many reasons including comorbidity, multiple prescribing physicians, inappropriate prescribing, access to different pharmacies, as well as self-medication with OTC and alternative products.[4,5,24,25] Regardless of the reason, those who take multiple medications have an elevated risk of adverse events. ■

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Table A
Sample size, estimated population and prevalence of selected characteristics, household and institutional populations aged 65 or older, Canada excluding territories, 1998/1999 (households) and 1996/1997 (institutions)

	Households			Institutions		
	Sample size	Estimated population	Prevalance	Sample size	Estimated population	Prevalance
		thousands	%		thousands	%
Total	2,851	3,488	100.0	1,711	185	100.0
Sex						
Men	1,108	1,518	43.5	457	50	27.2
Women	1,743	1,970	56.5	1,254	135	72.8
Age group						
65 to 74	1,539	1,999	57.3	261	28	15.2
75 to 84	1,037	1,222	35.0	603	64	34.8
85 or older	275	266	7.6	847	93	50.0
Education						
Less than secondary graduation	1,473	1,748	50.2	1,104	120	69.7
Secondary graduation or more	1,374	1,734	49.8	481	52	30.3
Proxy reporter						
Yes	317	522	15.0	1,013	111	60.0
No	2,534	2,966	85.0	698	74	40.0
Current medication use						
Yes	2,181	2,642	76.3	1,582	171	96.7
No	652	821	23.7	56	6	3.3
Multiple medication use						
Yes	367	445	12.8	876	94	53.1
No	2,466	3,018	87.2	762	83	46.9

Note: Detail may not add to totals because of missing values for some variables.
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions).

Table B
Chronic diseases used to estimate overall *Number of chronic conditions* for household and health institutions components of National Population Health Survey, 1998/1999 (households) and 1996/1997 (institutions)

	Households	Institutions
Asthma	√	√
Arthritis or rheumatism	√	√
Back problems excluding arthritis	√	
High blood pressure	√	√
Chronic bronchitis or emphysema	√	√
Diabetes	√	√
Epilepsy	√	√
Heart disease	√	√
Cancer	√	
Stomach or intestinal ulcers	√	√
Suffers from effects of stroke	√	√
Urinary incontinence	√	√
Difficulty controlling bowels		√
Bowel disorder/Crohn's Disease or colitis	√	√
Alzheimer's disease or other dementia	√	√
Cataracts	√	√
Glaucoma	√	√
Thyroid condition	√	√
Suffers from partial or complete paralysis		√
Osteoporosis or brittle bones		√
Kidney failure or disease		√
Other chronic condition	√	√

.. not available
Note: For health institutions, "Difficulty controlling bowels" and/or urinary incontinence was counted as one chronic condition.
Source: National Population Health Survey, cross-sectional files, 1998/1999 (households) and 1996/1997 (institutions).